

Microcrack Resistant Matrix Materials for Out-of-Autoclave Processing of Composite Cryogenic Tanks, Phase I

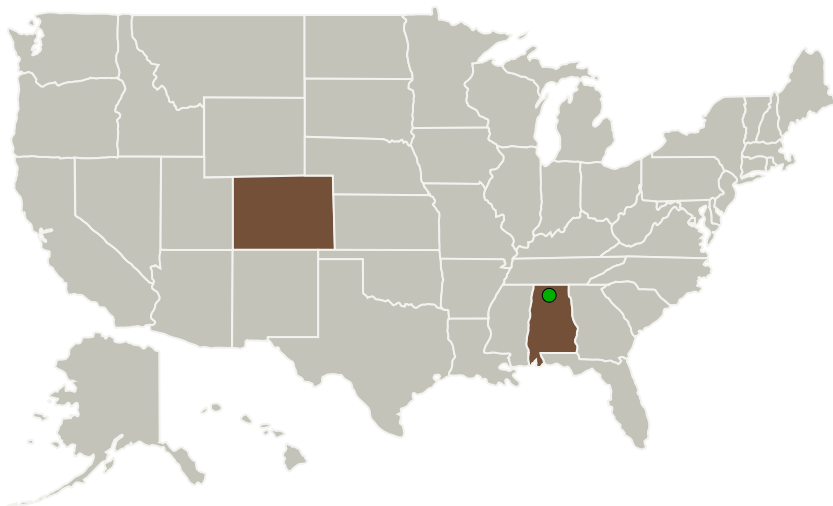
Completed Technology Project (2012 - 2012)



Project Introduction

The next generation of launch vehicles under development by NASA requires significant mass reduction to fully meet mission and performance needs. For example, NASA is aiming to create a new generation of heavy-lift launch vehicles to support both human spaceflight and space exploration missions. To ensure these vehicles can support all of the NASA needs, the mass of the propellant tanks must be significantly reduced, primarily through the use of composite materials. However, two primary challenges must be overcome to enable the use of composite tanks for these new classes of heavy launchers. One is to develop novel, microcrack-resistant, polymer matrix composite materials that will enable construction of 5 to 10 meter diameter composite tanks, and the second is to develop out-of-autoclave manufacturing methods that will enable the cost of these tanks to be 20-25% less than that of metal tanks. In the proposed program CTD plans to develop and evaluate new materials that will provide a strain to initiate microcracking that is 50% higher than that of the current materials. At the same time the materials will be optimized for out-of-autoclave processing of composite tanks. Of particular interest are low void content, long out-life, good tack properties, and out-of-autoclave cure characteristics. The Phase I material development effort will explore several polymer chemistries including toughened epoxies, Polybenzoxazines and a hybridized version of the Polybenzoxazines and toughened epoxies. At the end of Phase I, CTD will fabricate and test a 15-cm-diameter by 18-cm-long, 1.9L cylindrical subscale tank to demonstrate the processing feasibility and performance of the new material.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Composite Technology Development, Inc.	Lead Organization	Industry	Lafayette, Colorado
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Colorado

Project Transitions

▶ **February 2012:** Project Start

✓ **August 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140265>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Composite Technology Development, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

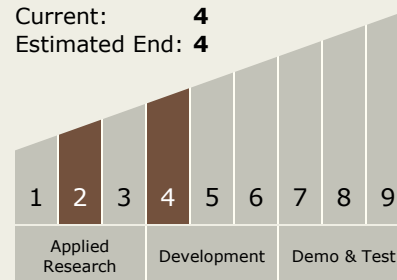
Kaushik Mallick

Technology Maturity (TRL)

Start: 2

Current: 4

Estimated End: 4



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.1 Lightweight Structural Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System